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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/612,174	07/02/2003	Robert K. Reich	MIT8806L	5221

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EXAMINER	
QUINTO, KEVIN V	

ART UNIT	PAPER NUMBER
2826	

DATE MAILED: 06/30/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/612,174	REICH ET AL.	
	Examiner	Art Unit	
	Kevin Quinto	2826	

-- The MAILING DATE of this communication appears on the cover sheet with th correspond nce address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 December 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-15 and 18-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sayag (USPN 5,585,847) in view of Reich et al. (USPN 5,270,558).

4. In reference to claims 1 and 9, Sayag (USPN 5,585,847) discloses a similar charge-coupled imager for imaging a sequence of image frames. Figure 7 of Sayag illustrates an array of super pixels disposed in a semiconductor substrate having a surface that is accessible to incident illumination. Each super pixel has a plurality of independently-controlled subpixels (column 5, lines 12-43). The control electrode (178) comprises three electrodes which correspond to three-phase photogenerated charge collection. Sayag does not disclose the use of a subpixel which utilizes a doped charge collection control layer in the substrate. However the use of such a device is well known in the art. Reich et al. (USPN 5,270,588, hereinafter referred to as the "Reich"

device) discloses a CCD which utilizes a doped charge collection control layer in the substrate. Figures 3-5 of Reich show a CCD with a doped photogenerated charge collection channel region (25) which is opposite the illumination accessible substrate surface (22). There is a charge collection channel region control electrode (33). Doped charge drain regions (15) are adjacent to the channel region (25). There is also a charge drain region control electrode (34). There is a doped charge collection control layer (26) in the substrate (22) below the charge collection channel region (25). The charge collection channel region (25), the charge drain regions (15), and the charge collection control layer (26) are each characterized by a dopant type and its concentration for expanding the charge collection channel region (25) in response to a charge collection control voltage applied to the channel region control electrode (33) in order to collect in the charge collection channel region (25) photogenerated charge during its designated image frame. Furthermore the charge collection channel region (25) contracts in response to a charge storage control voltage applied to the channel region control electrode (33) in order to store the collected photogenerated charge in the charge collection channel region (25) and collect substantially no additional photogenerated charge. Reich discloses that such a device has the benefit of a faster switching time (column 2, lines 51-57), which is a known goal in the art (column 1, lines 49-68 and column 2, lines 1-5). In view of Reich, it would therefore be obvious to use a CCD which utilizes a doped charge collection control layer in the substrate for the subpixel in the Sayag device.

5. With regard to claims 2 and 3, Reich discloses the use of a p^- substrate (22), an n-type charge collection channel region (25), n^+ charge drain regions (15), and a p^+ charge collection control layer (26).

6. In reference to claim 4, the charge collection channel region (25) comprises a buried channel disposed adjacent to a substrate surface (22) opposite the illumination-accessible substrate surface.

7. With regard to claim 5, the charge collection control layer (26) includes first sections that are at a first depth in the substrate (22) and located under a first section of the charge collection channel region (25) and all of the charge drain regions (15). The charge collection control layer (26) includes second sections that are at a second depth in the substrate (22) different from the first depth and located under a second section of the charge collection channel region (25).

8. In reference to claims 6 and 7, figure 4 of Reich shows that charge collection control voltage is selected to expand a depletion region of the charge collection channel region (25) into the substrate (22) to a depth greater than the depth of the charge collection control layer (26). In addition, figure 5 of Reich shows that charge collection control voltage is selected to contract a depletion region of the charge collection channel region (25) into the substrate (22) to a depth less than the depth of the charge collection control layer (26).

9. With regard to claim 8, the illumination-accessible substrate surface (22) is a back side of the substrate while the control electrodes (33) are disposed on the front side of the substrate.

10. In reference to claim 10 and 15, Sayag (USPN 5,585,847) discloses a similar charge-coupled imager for imaging a sequence of image frames. Figure 7 of Sayag illustrates an array of super pixels disposed in a semiconductor substrate having a surface that is accessible to incident illumination. Each super pixel has a plurality of independently-controlled subpixels (column 5, lines 12-43). The control electrode (178) comprises three electrodes which correspond to three-phase photogenerated charge collection. Sayag does not disclose the use of a subpixel which utilizes a doped charge collection control layer in the substrate in its array. However the use of such a device is well known in the art. Reich (USPN 5,270,588) discloses a CCD which utilizes a doped charge collection control layer in the substrate. Figures 3-5 of Reich show a CCD with a doped photogenerated charge collection channel region (25) which is opposite the illumination accessible substrate surface (22). There is a charge collection channel region control electrode (33). Doped charge drain regions (15) are adjacent to the channel region (25). There is also a charge drain region control electrode (34). There is a doped charge collection control layer (26) in the substrate (22) below the charge collection channel region (25). The charge collection channel region (25), the charge drain regions (15), and the charge collection control layer (26) are each characterized by a dopant type and its concentration for expanding the charge collection channel region (25) in response to a charge collection control voltage applied to the channel region control electrode (33) in order to collect in the charge collection channel region (25) photogenerated charge during its designated image frame. Furthermore the charge collection channel region (25) contracts in response to a charge storage control

voltage applied to the channel region control electrode (33) in order to store the collected photogenerated charge in the charge collection channel region (25). Each device has a channel region control voltage connection (32) on a substrate surface opposite the illumination-accessible surface which is configured for independent collection and storage of photogenerated charge from the substrate (2) at the charge collection channel region (25). Reich discloses that such a device has the benefit of a faster switching time (column 2, lines 51-57), which is a known goal in the art (column 1, lines 49-68 and column 2, lines 1-5). In view of Reich, it would therefore be obvious to use a CCD which utilizes a doped charge collection control layer in the substrate for the subpixel in the Sayag device.

11. In reference to claim 11, Reich shows that a drain region control voltage collection (34) is provided to each device or subpixel opposite the illumination accessible surface. The drain region control voltage collection (34) can be configured for drainage of photogenerated charge from the substrate (22) to a subpixel drain region (15) in response to a drain region control signal.

12. In reference to claims 12 and 13, the Reich device has a channel region control voltage which can be configured for collection and storage of photogenerated charge from the substrate (22) at the charge collection channel region (25). Furthermore, the channel region control voltage can be configured for subpixel-specific weighting of collection and storage of photogenerated charge from the substrate (22) at each subpixel. Sayag implies that at least two subpixels are functioning during a corresponding frame (column 5, lines 34-38).

13. With regard to claim 14, the Reich device has a channel region control voltage collection (33) which can be configured for control of the correspondence between the subpixels and the image frames. drainage of photogenerated charge from the substrate (22) to a subpixel drain region (15) in response to a drain region control signal.

14. In reference to claims 18-20, Sayag discloses the use of a serial output register and a column binning register in the substrate to accept a sequence of image frame charge from each super pixel after the image frame sequence is collected and stored at each super pixel (claims 1 and 5).

15. In reference to claims 21-24, Sayag (USPN 5,585,847) discloses a similar charge-coupled imager for imaging a sequence of image frames. Figure 7 of Sayag illustrates an array of super pixels disposed in a semiconductor substrate having a surface that is accessible to incident illumination. Each super pixel has a plurality of independently-controlled subpixels (column 5, lines 12-43). The control electrode (178) comprises three electrodes which correspond to three-phase photogenerated charge collection. Furthermore Sayag discloses that the number of subpixels as well as the length of the image frame sequence and image rate may be adjusted and configured (column 5, lines 29-67 and column 5, lines 1-30). Sayag also discloses that the number of subpixels is configurable to desired proportions (column 6, lines 18-30). In addition, the subpixels are collect and store at the super pixel each frame of the image frame sequence before transferring the image frame sequence from the super pixel (column 5, lines 38-43). Sayag implies that at least two subpixels are functioning during a corresponding frame (column 5, lines 34-38). Sayag does not disclose the use of a

subpixel which utilizes a doped charge collection control layer in the substrate in its array. However the use of such a device is well known in the art. Reich (USPN 5,270,588) discloses a CCD which utilizes a doped charge collection control layer in the substrate. Figures 3-5 of Reich show a CCD with a doped photogenerated charge collection channel region (25) which is opposite the illumination accessible substrate surface (22). There is a charge collection channel region control electrode (33). Doped charge drain regions (15) are adjacent to the channel region (25). There is also a charge drain region control electrode (34). There is a doped charge collection control region (26) in the substrate (22) below the charge collection channel region (25). Reich discloses that such a device has the benefit of a faster switching time (column 2, lines 51-57), which is a known goal in the art (column 1, lines 49-68 and column 2, lines 1-5). In view of Reich, it would therefore be obvious to use a CCD which utilizes a doped charge collection control layer in the substrate for the subpixel in the Sayag device.

16.

17. Claims 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sayag (USPN 5,585,847) in view of Reich et al. (USPN 5,270,558) as applied to claim 10 above and further in view of Rao et al. (USPN 6,037,822).

18. With reference to claim 16, neither Sayag nor Reich discloses the use of metal for the control signal lines. However the use of metal for signal lines is well known in the art. Rao et al. (USPN 6,037,822, hereinafter referred to as the "Rao" reference) discloses that metal is used for clock signal lines since it has a consistent and predictable resistance (column 2, lines 3-11). Furthermore Rao discloses that the

consistent resistance leads to a consistent clock signal speed which is desirable in the art (column 1, lines 67 and column 2, lines 1-3). In view of Rao, it would therefore be obvious to implement the control signal lines with a metal material.

19. In reference to claim 17, figures 3-4 of Reich illustrates the use of isolation lines (not labeled) between the control signal lines (32), the charge collection channel region control electrodes (33), and the drain control electrodes (34).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Quinto whose telephone number is (571) 272-1920. The examiner can normally be reached on M-F 8AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on (571) 272-1915. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KVQ

Minhloan Tran
Primary Examiner
Art Unit 2826